

# Floods In South Dakota, Spring 1995



Severe flooding occurred across South Dakota during the spring of 1995. Similar to the floods of 1993, high flows began during snowmelt and continued as spring rains moved into the area. Localized flooding resulted from heavy precipitation in the form of snow and rain that occurred during late March and April over much of the central and eastern parts of the State. Unusually heavy spring rains followed in late April and May, especially in the Black Hills area. Unlike the 1993 floods, which were confined mostly to the James, Vermillion, and Big Sioux River Basins, the severe 1995 flooding was Statewide.

## The Storms

A narrow band of heavy snow resulted from storms along the northern border in late February and by early March, snow depths were about 20 inches in the north-eastern part of the State. Following an early March storm, record low temperatures were equaled or exceeded at five cities in eastern South Dakota, including -32°F at Aberdeen on March 8. A very rapid warmup that began on March 10 caused ice breakup on many streams. Heavy precipitation occurred over central and eastern South Dakota April 8-12 and April 18 producing as much as 6 to 7 inches of moisture in the form of snow and rain. As much as 50 to 60 inches of snow fell in the central part of the State during the two storms, causing extended electrical outages and significant losses of newborn livestock. During April 28-30, another storm tracked across the southern part of the State; southwestern South Dakota received 1 to 2 inches of rain, the Black Hills of western South Dakota received 3 to 8 inches of snow, and the south-central and southeastern parts of the State received up to an inch of rain.

There were unusually intense rains in the western and northern Black Hills May 6-10. The storm produced widespread rainfall of 3 to 6 inches in much of the Black Hills, with reports of 6 to 10 inches in the northern Black Hills and

foothills. During May 7-10, 8.78 inches of precipitation was recorded at the U.S. Geological Survey (USGS) precipitation gage, Two Bit Gulch near Deadwood. The Two Bit Gulch gage recorded 13.43 inches in May. The rest of the State received 1 to 3 inches of rain May 7-10. Slow moving, intense thunderstorms over Memorial Day weekend in southeast South Dakota produced severe weather (tornadoes and hail) and more than 4 inches of rain in some areas. All-time record precipitation during March 1 through May 31 occurred at some locations (table 1) that have 100 or more years of record. Precipitation amounts, compiled by the South Dakota State Climatologist for March 1 through May 31 for selected National Weather Service stations across the State, are shown in figure 1.

## The Floods

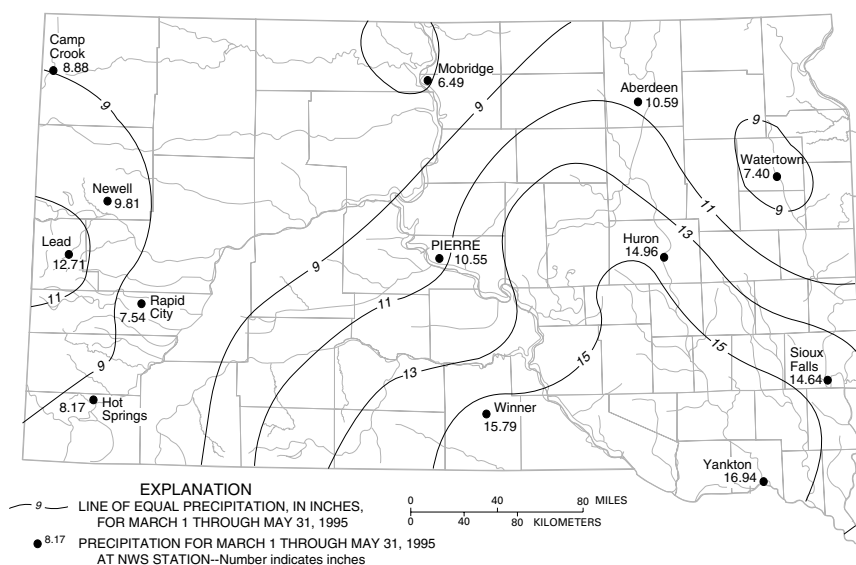
Flooding began in the Grand River and the upper James River basins when the snowpack began to melt in early to mid-March. Localized flooding during March and April also occurred at several locations because of severe backwater from ice jams. On March 14, ice jams caused

flooding that resulted in evacuation of 19 families from Wakpala and about 200 people from Bullhead, communities located on the Standing Rock Indian Reservation in north-central South Dakota. Above-normal snow and rainfall during late March and April added to the flooding, especially in eastern South Dakota. Additional precipitation during late April and May caused record stage and flow on many streams Statewide (table 2).

**Table 1.** Record precipitation during March 1 through May 31 for selected gages with 100 or more years of record

Location	March-May precipitation, in inches	
	1995 <sup>1</sup>	Previous record (year)
Faulkton	12.99	12.89 (1991)
Highmore	14.63	13.93 (1991)
Huron	14.96	12.80 (1942)
Mitchell	15.55	15.28 (1942)
Sioux Falls	14.64	13.78 (1920)
Yankton	16.94	15.89 (1883)

<sup>1</sup>Preliminary National Weather Service data (A.R. Bender, State Climatologist, written commun., June 1995)



**Figure 1.** Preliminary National Weather Service precipitation data for March 1 through May 31, 1995 (A.R. Bender, State Climatologist, written commun., June 1995).

**Table 2.** Comparison of peak stage and streamflow data for March 1 through May 31, 1995, to previous maximums at selected gaging stations for period of record

[mi<sup>2</sup>, square miles; ft, feet; ft<sup>3</sup>/s, cubic feet per second; --, no data, not computed, or not determined; <, less than; >, greater than]

Station number	Station name	Period of record (water years)	Contributing drainage area, (mi <sup>2</sup> )	Flood of March-May 1995				Previous maximum		
				Peak stage (ft)	Peak flow (ft <sup>3</sup> /s)	Date	Recurrence interval range <sup>1</sup> (years)	Peak stage (ft)	Peak flow (ft <sup>3</sup> /s)	Date
06354860	Spring Creek near Herreid	1963-86, 1989-95	220	12.25	1,680	3/15	10-25	12.56	1,570	7/27/93
06354882	Oak Creek near Wakpala	1985-95	356	18.58	5,000	3/14	--	17.73 18.35	3,780 <sup>2</sup> --	3/4/86 3/23/87
06402430	Beaver Creek near Pringle	1991-95	45.8	9.10	60	5/7	--	8.46	28	6/8/93
06402995	French Creek above Stockade Lake, near Custer	1991-95	68.7	7.40	375	5/8	10-25	7.31 --	-- 320	6/8/91 8/6/91
06403300	French Creek above Fairburn	1982-95	105	3.80	<sup>3</sup> --	5/8	--	2.73	329	3/7/87
06404800	Grace Coolidge Creek near Hayward	1990-95	7.48	7.62	378	5/8	--	7.23	210	6/3/91
06404998	Grace Coolidge Creek near Game Lodge, near Custer	1972, 1977-95	25.2	10.86	884	5/8	10-25	12.76 10.84	<sup>2</sup> -- 1,030	2/9/79 9/7/89
06406000	Battle Creek at Hermosa	1950-95	178	12.70	2,360	5/8	10-25	17.72	21,400	6/10/72
06406500	Battle Creek below Hermosa	1951-53, 1989-95	285	9.29	1,360	5/9	--	-- 8.57	2,060 --	5/23/52 6/8/93
06406920	Spring Creek above Sheridan Lake, near Keystone	1991-95	127	11.84	651	5/8	--	10.77	455	6/4/91
06407500	Spring Creek near Keystone	1946-47, 1987-95	163	7.15	1,100	5/9	10-25	-- 6.94	865 --	6/23/47 6/8/93
06410500	Rapid Creek above Pactola Reservoir, at Silver City	1954-95	292	7.88	839	5/8	10-25	10.44	2,060	5/15/65
06423010	Boxelder Creek near Rapid City	1978-95	128	33.09	1,050	5/10	<10	-- 31.65	253 --	5/18/78 6/17/93
06424000	Elk Creek near Roubaix	1946, 1992-95	21.5	--	354	5/8	--	7.87	154	6/8/93
06425100	Elk Creek near Rapid City	1981-95	190	12.05	2,860	5/9	10-25	10.79 11.80	1,560 <sup>2</sup> --	5/20/82 2/26/86
06428500	Belle Fourche River at Wyoming-South Dakota State line	1947-95	3,280	16.33	<sup>3</sup> --	5/10	--	15.59 14.03	4,400 4,550	6/18/62 6/30/93
06430500	Redwater Creek at Wyoming-South Dakota State line	1929-31, 1936-37, 1955-95	471	10.62	1,560	5/9	10-25	12.19	2,440	8/22/73
06430770	Spearfish Creek near Lead	1989-95	63.5	8.20	140	5/8	--	7.79 7.64	<sup>2</sup> -- 51	1/29/91 6/8/93
06430800	Annie Creek near Lead	1989-95	3.55	5.94	<sup>3</sup> --	5/8	--	5.18 4.96	<sup>2</sup> -- 19	3/17/93 6/8/93
06430850	Little Spearfish Creek near Lead	1989-95	25.8	5.34	65	5/10	--	4.95	22	4/25/94
06430898	Squaw Creek near Spearfish	1989-95	6.95	7.89	860	5/8	--	5.37	96	6/8/93
06430900	Spearfish Creek above Spearfish	1989-95	139	7.42	2,400	5/8	--	5.14	299	6/8/93
06431500	Spearfish Creek at Spearfish	1904, 1947-95	168	10.70	2,600	5/8	25-50	--	5,000	6/5/04
06432020	Spearfish Creek below Spearfish	1989-95	204	7.37	1,550	5/9	--	5.86 5.31	<sup>2</sup> -- 163	2/9/89 6/6/91
06433000	Redwater River above Belle Fourche	1946-95	920	8.83	4,610	5/9	10-25	11.69	16,400	6/6/62
06433500	Hay Creek at Belle Fourche	1954-95	121	10.23	1,310	5/9	100	9.15	930	6/19/72
06436000	Belle Fourche River near Fruitdale	1946-95	4,540	14.00	12,000	5/9	10-25	14.32	12,700	5/20/82
06436156	Whitetail Creek at Lead	1989-95	6.15	6.67	<sup>3</sup> --	5/8	--	3.56	39	7/20/93
06436170	Whitewood Creek at Deadwood	1982-95	40.6	10.54	5,000	5/8	25-50	7.54	2,660	5/15/82

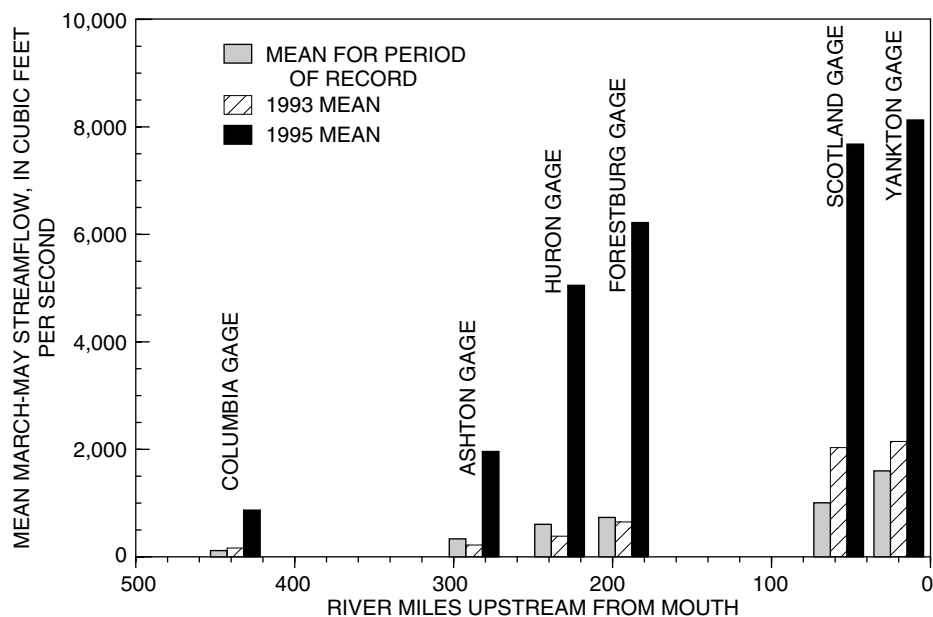
**Table 2.** Comparison of peak stage and streamflow data for March 1 through May 31, 1995, to previous maximums at selected gaging stations for period of record—Continued

Station number	Station name	Period of record (water years)	Contributing drainage area, (mi <sup>2</sup> )	Flood of March-May 1995				Previous maximum		
				Peak stage (ft)	Peak flow (ft <sup>3</sup> /s)	Date	Recurrence interval range <sup>1</sup> (years)	Peak stage (ft)	Peak flow (ft <sup>3</sup> /s)	Date
06436180	Whitewood Creek above Whitewood	1983-95	56.3	9.06	<sup>3</sup> --	5/8	--	5.68	2,080	6/5/91
06436190	Whitewood Creek near Whitewood	1982-95	77.4	6.01	<sup>3</sup> --	5/8	--	4.52	3,050	5/20/82
06436198	Whitewood Creek above Vale	1983-95	102	5.72	4,200	5/8	10-25	4.32 5.06	3,680 2,520	9/24/86 5/5/93
06436760	Horse Creek above Vale	1981-95	464	18.82	7,800	5/10	10-25	24.80	17,700	5/21/82
06437000	Belle Fourche River near Sturgis	1946-95	5,870	17.10	21,500	5/10	25-50	19.10	36,400	5/21/82
06437020	Bear Butte Creek near Deadwood	1989-95	16.6	8.85	2,000	5/8	--	7.70	938	6/5/91
06437500	Bear Butte Creek near Sturgis	1946-72, 1990-95	192	10.96	5,460	5/8	10-25	12.45	12,700	6/16/62
06438000	Belle Fourche River near Elm Springs	1929-32, 1934-95	7,210	15.29	29,500	5/10	10-25	15.90 18.22	45,100 40,300	6/8/64 5/21/82
06438500	Cheyenne River near Plainview	1951-81, 1994-95	21,600	19.57	35,000	5/10	10-25	--	41,700	5/26/57
06452320	Platte Creek near Platte	1989-95	741	11.29	2,600	5/11	--	7.24	1,600	6/17/93
06471000	James River at Columbia	1946-95	2,481	18.50	<sup>2</sup> --	5/13	--	16.15	2,340	5/3/79
				16.95	<sup>2</sup> 1,660	5/22	<10	17.11	<sup>2</sup> --	3/24/87
06471200	Maple River at North Dakota-South Dakota State line	1957-95	384	12.49	<sup>2</sup> 3,000	3/16	10-25	16.05	<sup>2</sup> 5,930	4/11/69
06471500	Elm River at Westport	1946-95	1,049	17.64 16.99	<sup>2</sup> -- 4,600	3/16 3/17	10-25	22.11	12,600	4/10/69
06472000	James River near Stratford	1950-72, 1977, 1995	4,860	19.86	<sup>3</sup> --	5/18-22	--	18.18 --	<sup>2</sup> -- 5,580	4/19/69 5/14-15/69
06473000	James River at Ashton	1946-95	5,673	22.39 21.21	<sup>2</sup> -- <sup>2</sup> 4,500	5/18 5/22	-- 25-50	21.17 20.63	<sup>2</sup> -- 5,680	4/13/69 4/24/69
06474000	Turtle Creek near Tulare	1953-56, 1965-81, 1984-95	1,124	14.28	4,300	5/11	10-25	18.51	<sup>2</sup> 6,000	4/5/69
06475000	James River near Redfield	1950-95	9,793	26.26	9,800	5/15	>100	24.93	7,310	4/13/69
06476000	James River at Huron	1929-32, 1944-95	11,721	16.86	10,000	5/19	50-100	16.70	9,000	4/13/69
06476500	Sand Creek near Alpena	1950-95	261	12.91	1,880	4/20	10-25	14.10 13.35	<sup>2</sup> -- 2,240	3/28/50 3/28/60
06477000	James River near Forestburg	1950-95	13,442	17.26 17.08	<sup>2</sup> -- 13,000	4/22 5/18	-- 25-50	17.16	12,500	4/9/69
06477500	Firesteel Creek near Mt. Vernon	1956-95	521	14.98	5,400	5/10	10-25	17.12 15.34	<sup>2</sup> -- 6,610	4/3/69 4/4/69
06478000	James River near Mitchell	1954-58, 1966-72, 1995	14,916	20.43	16,200	4/23	50-100	18.32	13,800	4/11/69
06478052	Enemy Creek near Mitchell	1975-87, 1989-95	163	13.55	3,500	5/10	10-25	15.15	4,280	6/22/84
06478300	Dry Creek near Parkston	1955-80, 1989-95	97.2	--	2,900	5/27	25-50	--	4,210	3/27/60
06478500	James River near Scotland	1929-95	16,505	19.41	18,200	5/29	25-50	20.45	29,400	6/23/84
06478513	James River near Yankton	1982-95	16,794	21.46	20,800	5/30	10-25	24.34	26,400	6/23/84
06478690	West Fork Vermillion River near Parker	1962-95	377	12.35	4,470	4/19	10-25	13.14	6,300	5/8/93

<sup>1</sup>Recurrence intervals generally only given for stations with 10 or more years of record through 1993.

<sup>2</sup>Stage-flow relation affected by backwater.

<sup>3</sup>Peak-flow value is not given because rating analysis and/or indirect-measurement computations were not complete when this Fact Sheet was prepared; contact USGS District office in Rapid City to check on status of these computations.



**Figure 2.** Mean March 1 through May 31 streamflow at James River gaging stations for period of record and 1993 and 1995.

Severe flooding occurred in western South Dakota and the Black Hills May 8-10. Flash flooding occurred across much of Butte, Custer, Lawrence, southwestern Meade, and western Pennington Counties. Damage to roads and bridges was widespread; rock and mudslides closed highways in Sturgis and in Boulder Canyon near Deadwood. Some smaller communities were isolated by road wash-outs. Many homes suffered water damage. About 120 Belle Fourche residents were forced from their homes on May 9 due to rising floodwaters. As the storms moved eastward, the flooding worsened in eastern South Dakota.

Streamflow on the James River was above flood stage from mid-March through May 31, 1995, and is compared in figure 2 to period-of-record and 1993 values at six gaging stations. The Missouri River reservoirs formed by the four main-stem dams in South Dakota were virtually full at the end of May and Lake Oahe was approaching a record elevation. Other lake levels in eastern South Dakota, especially in the northeast, exceeded levels that had not been reached in 100 years.

Of the 143 streamflow-gaging stations operated by the USGS in South Dakota, 34 stations that are listed in table 2 had record peak flow or stage. The other 22 stations listed in table 2 did not have record peaks, but recurrence intervals of the peaks exceeded 10 years. Several of

the stations with record peaks have periods of record less than 10 years. Most of the stations listed in table 2 had peak flow with recurrence intervals between 10 and 25 years. A few stations had peak flows with recurrence intervals in the 25- to 50-year range or the 50- to 100-year range. The May 9 peak flow of 1,310  $\text{ft}^3/\text{s}$  for Hay Creek at Belle Fourche had a recurrence interval equal to 100 years, and the May 15 peak flow of 9,800  $\text{ft}^3/\text{s}$  for the James River near Redfield exceeded 100 years.

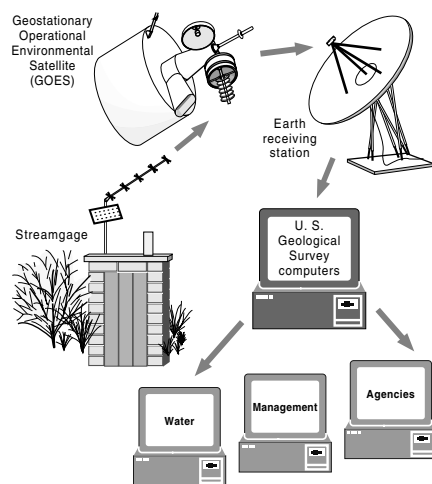
As a result of the severe storms and widespread flooding, 38 counties in South Dakota were approved for disaster relief by a Presidential Declaration signed on May 26. Interstate Highway 90 and many State and county highways were overtopped and subsequently closed for varying periods of time. Extensive agricultural damage occurred; for example, only 55 percent of the State's corn crop was planted as of June 4, compared to a 5-year average of 91 percent. By the end of May, the South Dakota Division of Emergency Management, working with FEMA, had conducted damage assessments in 35 counties and found that 1995 flood damage to State infrastructure already equaled the original 1993 flood-damage estimates.

## Monitoring Streamflow

The USGS operates a network of 121 continuous-record streamflow-gaging

stations and 22 crest-stage gages in South Dakota. The USGS also operates 47 precipitation gages in the Black Hills and one gage near Huron. During and after the flood, USGS personnel made flood measurements, indirect surveys, and surveyed high-water marks at more than 60 stations across the State.

At 31 of the streamflow stations, the data are relayed by satellite telemetry to computers in Rapid City, Huron, and Pierre (fig. 3). Data are transmitted every 15 minutes, and within 30 minutes these data generally are available to decision makers in the agencies involved in flood management. In addition, the USGS and cooperating agencies operate a network of telephone-accessible LARC and telemark gages where critical stage data are available on a real-time basis. The USGS Statewide data-collection network is readily available to local, county, State, and Federal agencies and to the public.



**Figure 3.** Schematic diagram showing how streamflow data are transmitted, processed, and distributed.

**Rainfall and streamflow data in this report are provisional and subject to change upon further review by personnel of the National Weather Service and the U.S. Geological Survey.**

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